REMARKS

Reconsideration and allowance of the above-identified application are respectfully requested. Upon entry of this Amendment, claims 47-92 will be pending. Claims 66 and 68 are amended herein to correct typographical errors. Claims 47, 50, 55, 61, 70, 73, 78 and 84 are amended herein as described below.

In the Office Action, claims 47-54 and 70-77 are rejected under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,694,389, to Seki et al (hereinafter Seki et al '389 patent), in view of U.S. Patent No. 5,771,224, to Seki et al (hereinafter Seki et al '224 patent). Claims 55-60 and 78-83 are rejected under 35 U.S.C. §102(e) as being anticipated by the Seki et al '389 patent. Finally, claims 61-69 and 84-92 are rejected under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,646,935, to Ishikawa et al (hereinafter the Ishikawa et al patent), in view of the Seki et al '389 patent). The Applicants respectfully traverse each of these claim rejections.

The present invention relates to signals having a frame structure and a frame synchronization of such signals. The signal comprises a reference symbol and, according to the present invention, the reference symbol is formed by performing an amplitude modulation of a bit sequence and inserting the amplitude-modulated bit sequence into the signal. As can be seen from Fig. 2 of the present application, for example, the amplitude-modulated bit sequence is inserted at 116 and therefore after conducting the inverse fast Fourier transform 110 such that the reference symbol is inserted in the time domain. At the receiver's end, the received signal is down-converted, an amplitude demodulation of the down-converted signal is performed in order to generate an envelope, and the envelope is correlated with a predetermined reference pattern in order to detect the signal reference pattern of the reference symbol in the signal. Then, frame synchronization is performed based on the detection of the signal reference pattern. As can be seen from Fig. 2 of the present application, the frame synchronization unit 134 is arranged upstream of the fast Fourier transform unit 140. Thus, according to the invention, the frame synchronization is conducted in the time domain.

As described on page 13, lines 4-32 of the present application as filed, the present invention permits for finding frame headers independently of other synchronization information and, thus, for positioning the fast Fourier transform windows correctly.

Thus, according to the present invention, the frame synchronization will be performed as the first synchronization task. Synchronization to the reference symbol, i.e. the frame header, is the first step to initiate radio reception. The reference symbol of the present invention is structured to accomplish this. Information contained in the reference symbol must therefore be independent of other synchronization parameters, e.g., the frequency. For this reason, in accordance with the present invention, the form of the reference symbol selected is an amplitude-modulated sequence in the complex base band. The information sequence is preferably selected in a way which makes it easy and secure to find it in the time domain.

As described on page 16, lines 1-20 of the present application as filed, the present invention shows how to find a reference symbol by a detection method which is simple. The synchronization methods according to the present invention are independent of other synchronization steps. If the information needed for the synchronization is contained in the envelope of the preamble, i.e. the reference symbol, the reference symbol is independent of possible frequency offsets. Thus, a derivation of the correct downsampling timing and the correct positioning of the FFT window can be achieved. The reference symbol of the present invention can be detected even if the frequency synchronization loop is not yet locked or even in the case of a barrier frequency offset. The frame synchronization method in accordance with the present invention is preferably performed prior to other and without knowledge of other synchronization efforts.

With regard to the rejection of claims 47-54 and 70-77 under 35 U.S.C. §103(a) in view of the Seki et al '389 patent in combination with the Seki et al '224 patent, the independent claims 47, 50, 70 and 73, as amended herein, each recite a frame structure wherein each frame has a reference symbol inserted therein in the time domain and as an amplitude modulated bit sequence. Neither the Seki et al '389 patent nor the Seki et al '224 patent singly, or in combination, teaches or suggests these aspects of the claimed invention, among other aspects.

According to the Seki et al '389 patent, a frequency reference symbol is used in order to detect the carrier frequency offset based on an offset of the position of decoded data of the frequency reference symbol (see column 4, lines 32 to 36). The structure of

the reference symbol according to the Seki et al '389 patent is described making reference to Fig. 3 thereof, i.e., on column 4, line 58 to column 5, line 41. According to the Seki et al '389 patent, one OFDM symbol consists of N carrier positions wherein the middle m carrier positions are frequency reference carrier positions for frequency references. With respect to the m frequency reference carrier positions carriers, carriers are arranged in a pattern of an M sequence (pseudonoise code), wherein no carriers are present when the code is "0" and carriers are present when the code is "1". Thus, according to the Seki et al '389 patent, carriers are present or not depending on the pseudonoise code. Thus, the carriers are modulated making use of the pseudonoise code, which does not teach or suggest amplitude modulation of a bit sequence and insertion of the amplitude modulated bit sequence into a signal, as recited in the independent claims 47, 50, 70 and 73 of the present application.

Moreover, according to the Seki et al '389 patent, the reference symbol generator 206 is provided upstream of the IFFT circuit 208, so that the reference symbol is inserted in the frequency domain. To more clearly emphasize this difference in the independent claims 47, 50, 70 and 73, the amended independent claims 47, 50, 70 and 73 recite that the amplitude-modulated bit sequence is inserted into said signal in the time domain.

According to the Seki et al '224 patent, a reference symbol is inserted in the frequency domain and the steps of evaluating the reference symbol are also conducted in the frequency domain. Thus, there is no suggestion or motivation to combine the Seki et al '389 patent and the Seki et al '224 patent or to modify the systems disclosed therein to render obvious the present invention recited in the amended independent claims 47, 50, 70 and 73. Accordingly, withdrawal of the rejection of claims 47-54 and 70-77 under 35 U.S.C. §103(a) in view of the Seki et al '389 patent in combination with the Seki et al '224 patent is believed to be proper and is respectfully requested.

With regard to the rejection of claims 55-60 and 78-83 under 35 U.S.C. §102(e) as being anticipated by the Seki et al '389 patent, independent claims 55 and 78 are directed to frame synchronization making use of such a reference symbol as described above. According to the Seki et al '389 patent, the reference symbols are used for detecting a carrier frequency offset, rather than for frame synchronization. Concerning this, reference is made to column 4, lines 35 to 39 and claim 1 of the Seki et al '389 patent.

Moreover, according to the Seki et al '389 patent, the amplitude detector and the correlator are provided downstream of the fast Fourier transform circuit 304 and therefore, the amplitude detection and the correlation are conducted in the frequency domain. Thus, in order to more clearly distinguish the present invention recited in claims 55-60 and 78-83 of the present application from the disclosure of the Seki et al '389 patent, independent claims 55 and 78 are amended herein to recite that amplitude demodulation and correlating are performed in the time domain. In addition, independent claims 55 and 78 are amended herein to recite that the reference symbol comprises an amplitude-modulated bit sequence. Thus, withdrawal of the rejection of claims 55-60 and 78-83 under 35 U.S.C. §102(e) is believed to be proper and is respectfully requested.

Finally, with regard to the rejection of claims 61-69 and 84-92 under 35 U.S.C. §103(a) in view of the Ishikawa et al patent and the Seki et al '389 patent, independent claims 61 and 84 are also amended herein to recite that amplitude demodulation and correlating are performed in the time domain. In addition, independent claims 61 and 84 are amended herein to recite that the reference symbol comprises an amplitude-modulated bit sequence. Neither Ishikawa et al patent nor the Seki et al '389 patent singly, or in combination, teaches or suggests these aspects of the claimed invention, among other aspects.

The Office Action refers to Fig. 3 of the Ishikawa et al patent to purportedly teach frame synchronization as recited in claims 61 and 84, except for correlating an envelope with a predetermined reference pattern in order to detect the signal reference pattern of a reference signal in a multi-carrier modulated signal. The Office Action relies on the Seki et al '389 patent to overcome this deficiency. As stated above, however, the amplitude detector and the correlator in the Seki et al '389 patent are provided downstream of the fast Fourier transform circuit 304; therefore, the amplitude detection and the correlation are conducted in the frequency domain. In addition, the reference symbols described in the Seki et al '389 patent are used for detecting a carrier frequency offset and not for frame synchronization. Accordingly, withdrawal of the rejection of claims 61-69 and 84-92 under 35 U.S.C. §103(a) is believed to be proper and is respectfully requested.

In view of the above, it is believed that the application is in condition for allowance and notice to this effect is respectfully requested. Should the Examiner have any questions, the Examiner is invited to contact the undersigned at the telephone number indicated below.

Respectfully submitted,

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